Resilience of lacustrine phytoplankton community to the short-term river-to-lake water diversion

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Cyanobacterial bloom induced by water eutrophication is one of the most serious ecological problems in freshwater lakes. Water diversion, transferring external freshwater into lakes, is proved to be the eco-hydraulic engineering measure rapidly relieving cyanobacterial blooms in eutrophic lakes. To explore the response of phytoplankton community to the changed aquatic habitat influenced by water diversion, we constructed the microcosm experiment modeling water diversion from Yangtze River to Lake Taihu in the laboratory, with one control group and three flow discharges groups of external freshwater from Wangyu River diversion channel during the summer water diversion period. Each modeling microcosm ecosystem had a volume of 5 L and was studied for a period of 20 days (10 days for the water diversion period and 10 days for the stop period). The results showed that the responses of physicochemical parameters in lake microcosms were sensitive, reflecting by the variations in contents of aquatic dissolved oxygen, total nitrogen, total phosphorus and dissolved silicate positively correlated with the flow discharges. During the period of water diversion, the cell abundances of Cyanophyta in all treat groups decreased significantly, while the abundances of Bacillariophyta increased, especially in the group with the highest flow discharge. The diversity and dominant species in phyla of Cyanophyta and Bacillariophyta were changed by water diversion and evidently in the highest flow discharge group. On the 20th day of the stop period, the relative proportion of Microcystis spp. recovered, and Pseudanabaena spp. became one of dominant cyanobacterial species in treat groups, which was related to the dominance of Pseudanabaena spp. in the external river water. The redundancy analysis between aquatic physicochemical parameters and phytoplankton communities revealed that variations in contents of aquatic dissolved oxygen, total nitrogen and dissolved silicate were the dominant environmental factors influencing lacustrine phytoplankton community in addition to the allochthonous inputs from external freshwater. However, the recovery of Microcystis spp. during the stop period of water diversion demonstrated that water diversion from Yangtze River to Lake Taihu has no sustainable effect on changing the dominance of Microcystis spp. in lakes in short time, although the diversity and phytoplankton community composition shifted during water diversion.